Seat Number

Nov-2019

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नवमी - 019

MATHEMATICS PAPER-I : MTH-201
Ordinary Differential Equations
(821101)

P. Pages : 4

Time : Two Hours **Max. Marks : 60**

Instructions to Candidates :

1. Do not write anything on question paper except Seat No.
2. Graph or diagram should be drawn with the black ink pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. All questions are compulsory.
5. Figures to the right indicate full marks.

1. a) Attempt **any six** of the following. 6

i) If $u = e^x \sin xy$ then $\frac{\partial u}{\partial x}$ at point (0, 0) is ------

a) 0 b) 1
c) 2 d) None of these

ii) If $Mdx + Ndy = 0$ is homogeneous differential equation, then I. F. is ----

a) $\frac{1}{Mx - Ny}$ b) $\frac{1}{Mx + Ny}$
c) $e^{\int f(x)dx}$ d) $e^{\int f(y)dy}$

iii) Equation $p^2 - 7p + 10 = 0$ is solvable for ----------

a) x b) y
c) p d) None of these

iv) Equation $y - px = x^4p^2$ is solvable for ----------

a) x b) y
c) p d) None of these

v) If f(D) is a polynomial in D with constant coefficients, $D \equiv \frac{d}{dx}$ and X is a function of x, then $\frac{1}{f(D)} xV = ----$

a) $\left[x - \frac{1}{f(D)} f'(D)\right] \frac{1}{f(D)} V$ b) $x \frac{1}{f(D)} V$

c) $V \frac{1}{f(D)} x$ d) None of these

vi) $\frac{1}{D^2 + a^2} \sin ax = ------$

a) $\frac{\sin ax}{2a}$ b) $\frac{\cos ax}{2a}$

c) $\frac{-x \cos ax}{2a}$ d) $\frac{x \sin ax}{2a}$

vii) If $D \equiv \frac{d}{dz}$ and $ax + b = e^z$ then $(ax+b)\frac{dy}{dx} = -----$

a) aDy b) $a^2D(D-1)y$

c) Dy d) $D(D-1)y$

viii) If $D \equiv \frac{d}{dz}$ and $z = \log(ax+b)$ then $(ax+b)^2 \frac{d^2y}{dx^2} = -----$

a) Dy b) $D(D-1)y$

c) aDy d) $a^2D(D-1)y$

b) Attempt **any six** of the following. 6

i) Define $f_x(a, b)$

ii) Define exact differential equation.

iii) A differential equation $f(x, y, p) = 0$ is said to be solvable for x if --------

iv) Is equation $\frac{1}{p} - p = \frac{y}{x} - \frac{x}{y}$ solvable for p?

v) If $f(D) = (D-a)^r \phi(D)$ with $\phi(a) \neq 0$ then $\frac{1}{f(D)} e^{ax} = ----$

vi) If $f(D)y = X$ is a linear differential equation with constant coefficients then its Associated equation is ---------

vii) To solve the equation $\frac{d^2y}{dx^2} - \frac{1}{x}\frac{dy}{dx} + \frac{1}{x^2}y = \frac{2}{x^2}\log x$, substitution is

$x =$ ------

viii) To express the equation

$(ax+b)^n \frac{d^ny}{dx^n} + p_1(ax+b)^{n-1}\frac{d^{n-1}y}{dx^{n-1}} + p_2(ax+b)^{n-2}\frac{d^{n-2}y}{dx^{n-2}}$

$+ - - - + p_n y = X$ into homogeneous linear equation form, substitution is ---------

2. Attempt **any six** of the following. 12

i) Define Bernoulli's equation.

ii) Define homogeneous differential equation.

iii) If $u = \log(x^2+y^2+z^2)$ then find $\frac{\partial u}{\partial z}$.

iv) Define differential equation of first order and higher degree.

v) Solve $y = px + a\sqrt{1+p^2}$.

vi) Solve $\frac{d^2y}{dx^2} - 5\frac{dy}{dx} + 6y = 0$.

vii) If $f(D)$ is a polynomial in D, $D \equiv \frac{d}{dx}$ and V is a function of x then

$\frac{1}{f(D)}e^{ax}V = - - - -$

viii) Define homogeneous Linear equation.

ix) Define Legendre's equation.

3. Attempt **any four** of the following. 12

i) If differential equation $Mdx + Ndy = 0$ is exact then show that $\frac{\partial M}{\partial y} = \frac{\partial N}{\partial x}$

ii) Solve $(2x^3+3y)dx + (3x+y-1)dy = 0$.

iii) Explain the method of solvable for y.

iv) Solve $y = 2px + yp^2$

v) Solve $\frac{d^2y}{dx^2} - 5\frac{dy}{dx} + 4y = e^{2x}$

vi) Solve $x^2\frac{d^2y}{dx^2} + x\frac{dy}{dx} - 4y = 0$

4. Attempt **any three** of the following. 12

i) Solve $x^2ydx - (x^3 + y^3)dy = 0$

ii) Define linear differential equation and explain method of solving it.

iii) Define Clairaut's equation and explain method of solving it.

iv) Solve $\frac{d^2y}{dx^2} - 9y = e^{2x} + x^2$.

v) Solve $(1+x)^2\frac{d^2y}{dx^2} + (1+x)\frac{dy}{dx} + y = 4\cos[\log(1+x)]$

5. Attempt **any two** of the following. 12

i) Explain the method of solving homogeneous linear equation.

ii) Solve $e^{3x}(p-1) + p^3e^{2y} = 0$ using substitution $e^x = u$, $e^y = v$.

iii) Solve $(D^2 - 2D + 1)y = x^2e^{3x}$.

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